

*Shaft Clamp Assembly***FIELD OF THE INVENTION**

This invention relates to a shaft clamp assembly, in particular, but not exclusively to a shaft clamp assembly for securing the shaft of a sun umbrella or weather screen to a supporting  
5 structure.

**BACKGROUND**

Increasingly weather screens, some in the form of umbrellas, are used in outdoor settings, for example street-side cafés, restaurant lawns, fairs, picnics and barbecues. They provide shelter from the sun or rain, and often also complement the appearance of a table setting, or  
10 even provide a means for displaying advertising.

Due to the large size of many of these umbrellas once opened out, they are often difficult to hold steady in even mild wind conditions. Most commonly very heavy and/or large base blocks or base members are used to hold the shaft of the umbrella. Because of the temporary or collapsible nature of umbrellas, they are items that are put up, moved around  
15 and put away regularly. These heavy or cumbersome bases are often the most difficult items to handle.

Sometimes umbrellas are held steady by inserting the lower end of the main shaft into the ground. This is often difficult to do, and in any case the ground often provides a poor support for the umbrella.

20 In addition to heavy base blocks, or holes in the ground, some bracket designs have been produced which comprise a circular tube in which the shaft of an umbrella is clamped. However, the forces acting on the body of the umbrella are often significant, and these brackets are often inadequate to support an umbrella in even light wind conditions. It is too easy for an umbrella shaft which is clamped into a circular tube to pivot a little about the  
25 clamp and to move. This often results in damage or wearing of the shaft, and excessive movement of the umbrella canopy.

Often the umbrellas that are used with an item of furniture, pass through a designated aperture in the furniture, and can gain some support from the furniture. However,

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umbrellas that are used with items of furniture in this way, even when heavy base blocks are used, are still prone to a degree of instability. Umbrellas can fly right out of a table setting in a gust of wind, or blow over.

Furthermore, umbrellas used in conjunction with tables are cumbersome to move. For example, if a street café owner wants to move a table around, he must struggle to move the table, the umbrella, and its base at the same time, or else dis-assemble the three items and move them separately. This process is difficult and may damage one or other of the table, umbrella or base, and in any event it is time consuming.

Poorly secured umbrellas can also become a danger to those around them. Umbrellas lifted or pushed over by a gust of wind can be quite dangerous to those in the vicinity.

In addition, the commonly used base blocks used with umbrellas can be unsightly and intrusive in a table setting. They can severely restrict foot-room under a table, and can make it difficult to stow chairs under a table when the table is not in use.

Another problem experienced with umbrellas and furniture is that as the sun moves, or the direction of rain changes, it is often desirable to alter the location of the umbrella relative to the item of furniture. This has been addressed to some extent by having a pivoting joint part way up an umbrella shaft, so that the canopy of the umbrella can be tilted. This solution is often inadequate in providing the optimum protection to those seated about an item of furniture.

## 20 OBJECT

It is therefore an object of the present invention to provide a shaft clamp assembly which will at least go some way towards making it simpler to secure an umbrella especially when used with items of furniture, or at least provide the public with a useful choice.

## STATEMENTS OF THE INVENTION

25 Accordingly, in a first aspect, the invention may broadly be said to provide a shaft clamp assembly comprising a bracket having a tubular member adapted to receive a shaft, means for mounting the tubular member to a structure, and clamping means, the clamping means being operable to secure the shaft to the tubular member, and wherein the internal wall of

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the tubular member is provided with at least two shaft contact surfaces, their arrangement being such that a polygon of forces is generated between the clamping means and the shaft contact surfaces to secure the shaft to the tubular member when the clamping means is operated.

- 5 Preferably the polygon of forces is a triangle of forces.

Preferably the tubular member comprises a tube having a substantially triangular cross section.

Preferably the radius of each apex of the substantially triangular cross section is less than the radius of a shaft which is to be supported by the shaft clamp assembly.

- 10 Preferably the clamping means includes at least one mechanism which is adapted to exert pressure on the shaft to push the shaft into contact with at least two contact surfaces on the internal wall of the tubular member.

Preferably the tubular member is provided with reinforcing members.

More preferably still the shaft contact surfaces are provided with reinforcing members.

- 15 Even more preferably the reinforcing members form part of the means for mounting the tubular member to a structure.

The means to grip the shaft could include at least one lever and cam arrangement to exert pressure onto the side of the shaft of an umbrella, to clamp it within the tube. However, preferably the clamping means includes at least one threaded shaft or rod, which is adapted

- 20 to engage with a mating thread associated with the tubular member.

Preferably the portion of the clamping means which contacts or grips the shaft incorporates a resilient member.

Preferably the thread associated with the tubular member further passes through one of the reinforcing members. Such an arrangement provides a longer and therefore stronger

- 25 threaded portion.

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The means for mounting the tubular member to a structure could include gusset pieces which are attachable to both the tubular member and to the structure, or it could include a substantially rigid plate or plates securely attached to the tubular member. However, preferably the means for mounting the tubular member to a structure comprises at least one  
5 strut.

Preferably the or each strut is provided with means to secure one end of each strut to a support.

More preferably said means to secure one end of each strut to a support is holes in a tab portion of the or each strut.

- 10 The shaft clamp assembly can be made from plastics material, however, preferably the shaft clamp assembly is primarily made from a metal or metal alloy.

In a second aspect, the invention may broadly be said to consist in an item of furniture, incorporating a shaft clamp assembly substantially as specified herein.

- Optionally an aperture in the item of furniture, need not necessarily be substantially  
15 centrally located, within for example a table top. With such a non-centred arrangement the item of furniture and umbrella can be re-orientated to achieve optimum protection for the users as the sun moves or the direction of rain changes. Such an arrangement is particularly useful if the umbrella is not a hinged umbrella. It will be realised that such a process will be far harder to achieve using some of the prior art arrangements, for example if a heavy  
20 base member were used to support the umbrella.

In a third aspect, the invention may broadly be said to consist in an item of furniture and an umbrella shaft and/or an umbrella incorporating a shaft clamp assembly substantially as specified herein.

## DESCRIPTION

- 25 The invention may also broadly be said to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of the parts, elements or features, and

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where specific integers are mentioned herein which have known equivalents, such equivalents are incorporated herein as if they were individually set forth.

One preferred form of the invention will now be described, by way of example only, with reference to the accompanying drawings in which,

5 **FIGURE 1** is a perspective view of a shaft clamp assembly,

**FIGURE 2** is a side elevation of the shaft clamp assembly,

**FIGURES 3, 3a and 3b** are respectively a cross sectional view through the clamping means of the shaft clamp assembly, a vector diagram showing a triangle of forces and a cross section of the end of the clamping means,

10 **FIGURE 4** is a perspective view of an item of furniture fitted with the shaft clamp assembly, complete with an umbrella installed,

**FIGURE 5** is a perspective view showing the use of the shaft clamp assembly to support a sun umbrella on a solid foundation, and the use of a second shaft clamp assembly to support a table top from the shaft of an umbrella, and

15 **FIGURE 6** is a perspective view showing the use of the shaft clamp assembly to support a clothesline.

With reference to **Figures 1 and 2**, a shaft clamp assembly (10) is shown comprising at least a tubular member (11) of substantially uniform thickness, three struts (13), and a pair of clamping means (15). The tubular member (11) is formed from a substantially  
20 triangular cross sectioned tube having three distinct flat side walls, and curved apexes. Each clamping means (15) comprises a threaded rod (17) the proximal end of which is secured to the centre of a knob (19). The threaded rod (17) engages with a mating thread which is formed in one of the flat side walls of the tubular member (11).

The arrangement of the struts (13) is such that an elongate portion of each strut (13)  
25 provides reinforcement for each respective flat side wall of the tubular member (11). In addition, the mating thread extends through this reinforcement portion of one of the struts (13) providing a longer and therefore stronger mating thread.

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The struts (13) are used as a means for mounting the tubular member (11) to a structure. Clearly, while struts (13) have been used in this example, a variety of means for mounting the tubular member (11) to a structure could be used, for example, a flat plate which is welded to the tubular member (11).

- 5 The struts (13) are formed from a flat bar section and are each attached by welding to the exterior surface of a flat side wall of the tubular member (11), the welded attachment extending along the majority of the length of the tubular member (11). Such an attachment means that part of each strut (13) is able to reinforce the tubular member (11). The free ends of the struts (13) are further provided with tabs or feet (25), and each of the feet (25)
- 10 have five drilled holes (27) for the insertion of bolts or screws when fastening the shaft clamp assembly (10) to a structure.

While the invention is not limited to the use of three struts (13), this number of struts (13) is advantageous because the shaft clamp assembly (10) will not tend to wobble if fitted to a surface of a structure that is not perfectly flat, for example when fitted to the under surface

15 of a table where the table top has been manufactured from different thicknesses of wood.

With reference to **Figure 3**, the shaft (31) of an umbrella (31) can be inserted as shown into the tubular member (11) and secured using the clamping means (15). It is secured by turning one and preferably both of the knobs (19) and winding the threaded rods (17) towards the shaft (31) so that the ends (33) of the rods (17) push against the shaft (31)

20 thereby clamping the shaft (31) between the rod (17) and a first and a second shaft contact surface (35) and (37) of the tubular member (11). The first and second shaft contact surfaces (35) and (37) are the internal faces of the two flat side walls of the tubular member (11) which do not contain the rod (17).

**Figure 3a** shows a triangle of forces which exists when the shaft (31) is clamped within the tubular member (11). Vector (17a) represents the force exerted by the threaded rod (17), vector (35a) represents the reaction force exerted by the shaft contact surface (35) and vector (37a) represents the reaction force exerted by the shaft contact surface (37). The tubular member (11) in this example has a triangular cross section which is similar to an equilateral triangle, that is, it has three flat side walls which are each arranged at sixty

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30 degrees to one another. For this reason, the triangle of forces, in which each individual

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force acts at ninety degrees to their respective flat side wall, is also a triangle with vectors at sixty degrees to one another.

The triangular cross sectioned tubular member (11) as shown in Figure 3 has been found to produce a very effective clamp for the purpose of securing a sun umbrella. The shaft (31) of the umbrella is held securely along the length of the tubular member (11) since the shaft (31) is effectively wedged into a corner along the length of the triangular tubular member (11). Even if only a single clamping means (15) is used, the shaft (31) is constrained along two distinct lines, which are the lines of contact between the shaft (31) and the first and second contact surfaces (35) and (37) of the interior of the tubular member (11). These lines of constraint partially oppose one another.

A reaction force acts from each partially opposing line of constraint. These forces in combination with a third opposing force exerted by the clamping means (15) produce the triangle of forces which is exerted onto the shaft (31). The triangle of forces act to largely eliminate any tendency for the shaft (31) to rock or move within the shaft clamp assembly (10) when external loads are applied to the shaft (31). It is believed that this greatly improved constraint of the shaft (31) is not experienced with prior art shaft clamp assemblies which are most commonly formed using a tubular member which has a circular cross section. Where the tubular member has a circular cross section, there is typically only a single line of contact between a shaft and the tubular member, and for this reason the shaft is able to rock or move within the tubular member with relative ease. And since the shafts of sun umbrellas experience relative large forces due to the effects of wind loads on the canopy of the umbrella, the restraint of the shaft within a shaft clamp assembly is important.

Whilst the shaft clamp assembly (10) will work well with only one clamping means (15), there is an advantage in providing two or more clamping means (15). If two clamping means (15) are used, one can be positioned towards each end of the tubular member (11) to further improve the ability of the shaft clamp assembly (10) to firmly attach to a shaft, with very little possibility of the shaft rocking or moving in any axis within the shaft clamp assembly (10).

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In this example, the clamping means (15) is in the form of a threaded rod (17) and a knob (19), but clearly many other types of clamping means could be used, for example a lever and cam arrangement. However, the clamping means (15) used in the example is advantageous in that it is simple, and it can be used to clamp against shafts of varying diameters without the need for any adjustment of the clamping means.

**Figure 3b** shows an optional arrangement of the distal or free end (33) of the threaded rod (17). In this option, a concentric hole is formed in the free end (33) of the threaded rod (17), and a complimentary mating "T" shaped plug (34) which is made of a suitable resilient material is inserted into the hole. The plug (34) covers the free end (33) and helps to minimise damage to the surface of a constrained shaft (31), which may otherwise be caused by the free end (33) of the threaded rod (17) when the shaft clamp assembly (10) is in use. In this case, the plug (34) is made from a plastics material.

With reference to **Figure 4**, a shaft clamp assembly (10) is shown fitted to the underside surface of an outdoor table (39). The shaft (31) of the umbrella (41) passes through an aperture (43) substantially centrally located within the table top (45) and the shaft (31) is rigidly secured in the shaft clamp assembly (10). With this arrangement no additional base is required for the umbrella, and neither is it necessary to engage the bottom of the shaft (31) with the ground.

The assembly of the table (39), shaft clamp assembly (10) and umbrella (41) has improved resistance to light winds, can easily be moved as an assembly, and provides good leg and foot room under the table. As discussed earlier, if the aperture (43) in the table top, and the shaft clamp assembly (10) were situated offset from the centre of the table (39), the table (39) could be orientated to give the best shelter, depending on the angle of the sun, or the direction of the rain.

With reference to **Figures 5 and 6**, two additional methods of use of the shaft clamp assembly (10) are shown.

In figure 5 a first shaft clamp assembly (10) is used to secure the shaft (10) of an umbrella (41) to a support (60). The support (60) can take many forms, for example a plinth, a concrete foundation, or a handrail, etc. A second shaft clamp assembly (10) is used to



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secure a table top or platform (47) to the shaft (31) of an umbrella. The table top or platform (47) can be mounted at any height above the ground to form a table for a range of purposes, for example a table to lean on, a table to sit at, or a drinks table to use whilst seated on the ground.

- 5 While this example shows a table top (47) secured to a shaft (31), many items such as spot lights, speakers etc, could be secured to a shaft using the shaft clamp assembly (10).

In figure 6 a shaft clamp assembly (10) is used to attach a shaft (49) of a clothesline (51) to a support (not shown).

- 10 The examples shown in Figures 4, 5 and 6 show the versatility of the shaft clamp assembly (10) as specified herein. There will also be a number of other uses for it, for example, supporting an advertisement banner, supporting a road sign, or the like.

#### ADVANTAGES

- 15 Thus it can be seen that at least the preferred form of the invention provides a shaft clamp assembly (10) that is capable of securing the shaft of an umbrella (41) to an item of furniture (39), such that the umbrella (41) has good stability, the item of furniture (39) can be moved with relative ease. Similarly it is easier to stow seats under a table (39) incorporating the invention, as the seats would no longer conflict with a large conventional umbrella base block.

- 20 And, safety can be enhanced in that the chance of an umbrella (41) being blown out of a table (39), or being blown over, in the wind is likely to be reduced. Stability of the table (39) can also be improved since the clamped umbrella shaft (41) can act as an extra leg for the table.

- 25 The shaft clamp assembly (10) is also very versatile and can be used to support the shafts of a range of items, such as clotheslines, banners, signposts, and it can equally be used to secure an item to a shaft, such as a table top, a light, etc.